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What is Claimed is:

1 ~~sub A'~~ A combination of additives for use in a brightening stage of
 2 pulps containing less than 18% lignin, said combination comprising: an aqueous
 3 sodium silicate solution; an alkali agent added in an amount sufficient to maintain
 4 a pH of said solution at least about 8; and a magnesium compound which
 5 dissociates in said solution to form $\text{Mg}(\text{OH})^+$ cations, wherein said magnesium
 6 compound is added in an amount to achieve, along with any other dissociated
 7 magnesium, an $\text{Mg}:\text{SiO}_2$ mass ratio of between about 1:46 to about 1:2.

1 2. A combination of additives in accordance with claim 1,
 2 wherein said $\text{Mg}:\text{SiO}_2$ mass ratio is between about 1:15 to about 1:3.

1 3. A combination of additives in accordance with claim 1,
 2 wherein said alkali agent is added in an amount sufficient to maintain the pH of
 3 said solution within the range of from about 8 to about 12.

1 4. A combination of additives in accordance with claim 1,
 2 wherein said magnesium compound is magnesium sulfate, added as MgSO_4 or
 3 $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$.

1 5. A combination of additives in accordance with claim 1,
 2 wherein:

3 said aqueous sodium silicate solution is added in an amount to
 4 achieve a concentration of from about 0.14% to about 1.4% SiO_2 on pulp; and

5 said magnesium compound is added in an amount to achieve a
 6 concentration of from about 0.01% to about 0.2% Mg on pulp.

1 6. A combination of additives in accordance with claim 5,
 2 wherein:

3 said aqueous sodium silicate solution is added in an amount to
 4 achieve a concentration of from about 0.28% to about 1.12% SiO_2 on pulp; and

5 said magnesium compound is added in an amount to achieve a
 6 concentration of from about 0.02% to about 0.2% Mg on pulp.

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1 7. A combination of additives in accordance with claim 1,
2 wherein said alkali agent is selected from the group consisting of at least one of
3 NaOH, Na₂O, MgO, Mg(OH)₂, K₂O, KOH, CaO, and Ca(OH)₂.

1 8. A combination of additives in accordance with claim 1,
2 wherein said magnesium compound is selected from the group consisting of at
3 least one of MgO, MgCl₂, Mg(OH)₂ and MgNO₃.

1 ~~sub 12~~ 9. An aqueous composition for use in a brightening stage of
2 pulps comprising:

3 pulp containing less than 18% lignin;

4 an aqueous sodium silicate solution;

5 an alkali agent added in an amount sufficient to maintain the pH at
6 least about 8; and

7 a magnesium compound which dissociates in said solution to form
8 Mg(OH)⁺ cations, wherein said magnesium compound is added in an amount to
9 achieve, along with any other dissociated magnesium, an Mg:SiO₂ mass ratio of
10 between about 1:46 to about 1:2.

1 10. An aqueous composition in accordance with claim 9, wherein
2 said Mg:SiO₂ mass ratio is between about 1:15 to about 1:3.

1 11. An aqueous composition in accordance with claim 9, wherein
2 said alkali agent is added in an amount sufficient to maintain the pH of said
3 solution within the range of from about 8 to about 12.

1 12. An aqueous composition in accordance with claim 9, wherein
2 said magnesium compound is magnesium sulfate, added as MgSO₄ or
3 MgSO₄·7H₂O.

1 13. An aqueous composition in accordance with claim 9, wherein:
2 said aqueous sodium silicate solution is added in an amount to
3 achieve a concentration of from about 0.14% to about 1.4% SiO₂ on pulp; and

4 said magnesium compound is added in an amount to achieve a
5 concentration of from about 0.01% to about 0.2% Mg on pulp.

1 14. An aqueous composition in accordance with claim 13,
2 wherein:

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said aqueous sodium silicate solution is added in an amount to achieve a concentration of from about 0.28% to about 1.12% SiO₂ on pulp; and

said magnesium compound is added in an amount to achieve a concentration of from about 0.02% to about 0.2% Mg on pulp.

15. An aqueous composition in accordance with claim 9, wherein said alkali agent is selected from the group consisting of at least one of NaOH, Na₂O, MgO, Mg(OH)₂, K₂O, KOH, CaO and Ca(OH)₂.

16. An aqueous composition in accordance with claim 9, wherein said magnesium compound is selected from the group consisting of at least one of MgO, MgCl₂, Mg(OH)₂ and MgNO₃.

17. An aqueous composition in accordance with claim 9, wherein said pulp contains less than 5% lignin.

18. An aqueous composition in accordance with claim 17, wherein said pulp contains less than 2% lignin.

19. An aqueous composition in accordance with claim 9 further comprising hydrogen peroxide.

20. A method for brightening pulp comprising the steps of:
mixing pulp containing less than 18% lignin with hydrogen peroxide, an aqueous sodium silicate solution; an alkali agent added in an amount sufficient to maintain the pH of said solution at least about 8; and a magnesium compound which dissociates in said solution to form Mg(OH)⁺ cations, wherein said magnesium compound is added in an amount to achieve, along with any other dissociated magnesium, an Mg:SiO₂ mass ratio of between about 1:46 to about 1:2, to form a mixture; and

heating said mixture to allow said mixture to react to cause a portion of said lignin to degrade.

21. A method in accordance with claim 20 further comprising pressurizing said mixture with an oxygen-containing gas.

22. A method for delignifying and brightening pulp comprising the steps of:

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3 mixing pulp containing less than 18% lignin with an aqueous sodium
4 silicate solution; an alkali agent added in an amount sufficient to maintain the pH
5 of said solution at least about 8; and a magnesium compound which dissociates in
6 said solution to form $\text{Mg}(\text{OH})^+$ cations, wherein said magnesium compound is
7 added in an amount to achieve, along with any other dissociated magnesium, an
8 $\text{Mg}:\text{SiO}_2$ mass ratio of between about 1:46 to about 1:2, to form a mixture;

9 pressurizing said mixture with an oxygen-containing gas; and
10 heating said mixture to allow said mixture to react to cause a portion
11 of said lignin to degrade.

1 23. A method in accordance with claim 22 wherein the oxygen
2 partial pressure is in the range of between about 0.38 to about 1.48 MPa.

1 ~~24.~~ A method for brightening pulp containing transition metals
2 and less than 18% lignin, said method comprising the steps of:

3 forming a sodium silicate solution having a high percentage of high
4 molecular weight silicates by mixing sodium silicate and a magnesium compound
5 which dissociates in said solution to form $\text{Mg}(\text{OH})^+$ cations; and

6 adding said sodium silicate mixture to said pulp to adsorb at least a
7 portion of said transition metals.

1 25. A method of claim 24, wherein said sodium silicate mixture
2 has at least 25% of the silicates with molecular weight of at least 10,000 daltons.

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